An Early Warning System for lake outburst floods of the Laguna 513, Cordillera Blanca, Peru

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INTRODUCTION

In April 2010, an ice avalanche from Hualcán impacted a glacier lake (Laguna 513) in the Cordillera Blanca, Peru. It triggered a flood wave that caused damage in downstream population centers, including the city of Carhuaz. Drainage tunnels in the rock dam, constructed in the 1990’s, prevented the downstream areas from larger damages. Here we present an Early Warning System (EWS) that has been designed and implemented as a consequence of this event.

STATIONS & SENSORS

Station Laguna 513
- 2 cameras (glacier, dam)
- 4 geophones
- transmission of data from Pampa Shonquill to repeater station

Station Pampa Shonquill
- 1 geophone
- 1 pressure sensor (in the river)
- 1 camera (with IR night vision)

Climate station:
- Temperature & rel. humidity
- Wind sensor
- Pluviometer
- Solar radiation

Data center
- Located in a separate room in the building of the municipality of Carhuaz
- Interface for real-time data observation; data storage; IP for remote data access
- Alarm will be given from here

ALERT, ALARM & EVACUATION

A flowchart with four different levels of alert, ranging from “limited or zero danger” to “Alarm / Evacuation” support the authorities in taking adequate decisions (figure to the right). This document is accompanied by a list with phone numbers of all involved stakeholders and their deputies.

After setting up all instruments and sensors, a 1-year test phase is scheduled to define threshold values of the sensor measurements.

On the alarm (red) level, the mayor of Carhuaz can command evacuation, which is announced by alarm sirens. Based on the hazard map (figure further right), a plan with evacuation routes has been designed for the city of Carhuaz, which brings people on the shortest ways to safe zones, and avoids crossing zones of higher hazard.

The new hazard map provides the basis for the planning of evacuation routes. Simulations prepare the population for the case of emergency.

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